Letter to the Editor

Red meat allergy in Sweden: Association with tick sensitization and B-negative blood groups

To the Editor:

Over the past few years, allergy to mammalian meat has been identified as a new syndrome of food allergy presenting as symptoms of delayed severe allergic reactions after consumption of red meat (beef, lamb, or pork).[1-4] These allergic reactions are directed against the carbohydrate galactose-α-1,3-galactose (α-Gal). In the initial studies on red meat allergy, Commins et al[5] observed that the geographic distribution of IgE antibodies to α-Gal in the United States overlapped the region where the tick *Amblyomma americanum* is common, suggesting that tick bites might be relevant to these reactions. Since then, several reports have confirmed a relationship between tick bites and red meat allergy.[6,7] We have recently identified α-Gal in the gastrointestinal tract of the European tick *Ixodes ricinus*, which provides further evidence of the tick as an initiator of red meat allergy.[7]

In this study we have identified 39 patients with a history of allergic reactions after consumption of mammalian meat and IgE against α-Gal (ImmunoCAP; Thermo Fisher Scientific, Uppsala, Sweden; median, 20 kU_A/L; range, 1.3-130 kU_A/L; Table I). With the exception of 2 patients, they all described delayed symptoms in which urticaria was dominant, but as many as 45% had experienced anaphylaxis (Table I). All patients had IgE against

TABLE I. Characteristics of patients with meat allergy

Patient no.	Age (y)/sex	Reaction	Time to reaction†	IgE*					Tick bites‡	Blood group
				Total	α-Gal	Beef	*I ricinus*	*A americanum*		
1	67/M	AE, GI, U	6	260	54	5.0	30	5.2	+++	A
2	40/F	ANA, GI, U	3-4	120	16	3.5	0.46	<0.10	++	A
3	63/F	GI, U	2	20	13	5.5	0.60	<0.10	++	A
4	69/M	AE, GI, U	4	280	23	11	40	6.0	+++	A
5	39/M	AE, GI, U	4-5	33	6.4	4.4	0.72	<0.10	++	A
6	74/M	U	3-4	210	30	10	1.9	<0.10	+	A
7	51/M	ANA, U	4-5	25	2.2	1.4	0.17	<0.10	+++	A
8	48/F	AE, ANA, GI, U	0.25-1	150	16	7.9	4.7	<0.10	+++	O
9	43/M	AE, ANA, GI, U	8	320	88	11	3.1	0.15	+++	O
10	69/M	GI, U	6	87	18	4.9	1.5	<0.10	+	A
11	46/M	GI	2	90	4.4	2.2	0.35	<0.10	+	O
12	70/M	AE, U	6	420	130	16	37	1.5	+++	O
13	48/F	GI, U	2-6	870	6.2	11	2.8	0.87	++	A
14	44/M	AE, ANA, GI, U	4-7	1800	24	4.5	10	2.6	++	O
15	33/F	AE, ANA, GI, U	6-7	270	46	7.2	0.34	<0.10	+	O
16	65/F	AE, ANA, U	6	550	31	22	13	11	+	O
17	69/M	AE, U	10-12	130	25	20	8.1	0.13	+	A
18	63/F	AE, ANA, GI, U	3-4	140	20	3.0	0.17	<0.10	+	A
19	38/F	GI, U	6	140	19	3.2	2.3	0.23	++	A
20	54/M	ANA, GI, U	2	20	3.6	1.1	0.27	<0.10	+	O
21	74/F	AE, GI, U	8	30	1.6	0.53	0.3	<0.10	++	A
22	36/M	GI, U	6-7	80	22	3.3	2.1	0.11	+++	O
23	60/M	AE, ANA, U	6-7	2200	76	6.2	54	5.9	+++	O
24	54/F	ANA, U	5-6	130	19	3.8	2.9	<0.10	+++	A
25	37/F	AE, ANA, GI, U	6-7	110	12	2.8	1.2	<0.10	+	O
26	57/F	GI, U	2-8	50	29	6.3	0.61	<0.10	+	A
27	69/M	AE, ANA, GI, U	6	48	6.6	0.49	<0.10	<0.10	+++	O
28	49/M	ANA, U	7	48	10	1.8	0.36	<0.10	++	A
29	57/M	U	3	33	2.4	0.25	0.11	<0.10	++	O
30	52/F	AE, ANA, U	1-2	87	12	5.4	2.7	<0.10	++	O
31	73/M	GI	ND	340	37	6.0	1.4	1.3	+	O
32	45/F	AE, U	5	44	5.0	0.3	<0.10	<0.10	++	AB
33	36/F	AE, GI, U	4-5	120	37	9.9	6.9	0.32	+++	O
34	44/F	U	2-7	240	110	9.7	0.26	<0.10	++	O
35	40/M	GI, U	6	270	84	28	3.3	<0.10	++	O
36	41/F	GI, U	3	360	61	12	1.5	<0.10	+	A
37	18/F	AE, ANA, GI, U	4-8	180	1.3	0.93	0.56	0.64	+	O
38	55/M	GI, U	4-12	150	22	1.9	4.4	<0.10	+++	B
39	70/M	AE, ANA, GI, U	0.25-3	150	23	1.9	3.6	<0.10	++	O

AE, Angioedema; *ANA*, anaphylaxis; *F*, female; *GI*, gastrointestinal symptoms; *M*, male; *ND*, not determined; *U*, urticaria.

*ImmunoCAP IgE results: total IgE levels are expressed in kilounits per liter, and allergen-specific IgE levels are expressed in kilounits of allergen per liter.

†Reported time to reaction expressed in hours.

‡Estimated total number of tick bites: +, 1 to 10; ++, 10 to 50; and +++, 50 to 100.

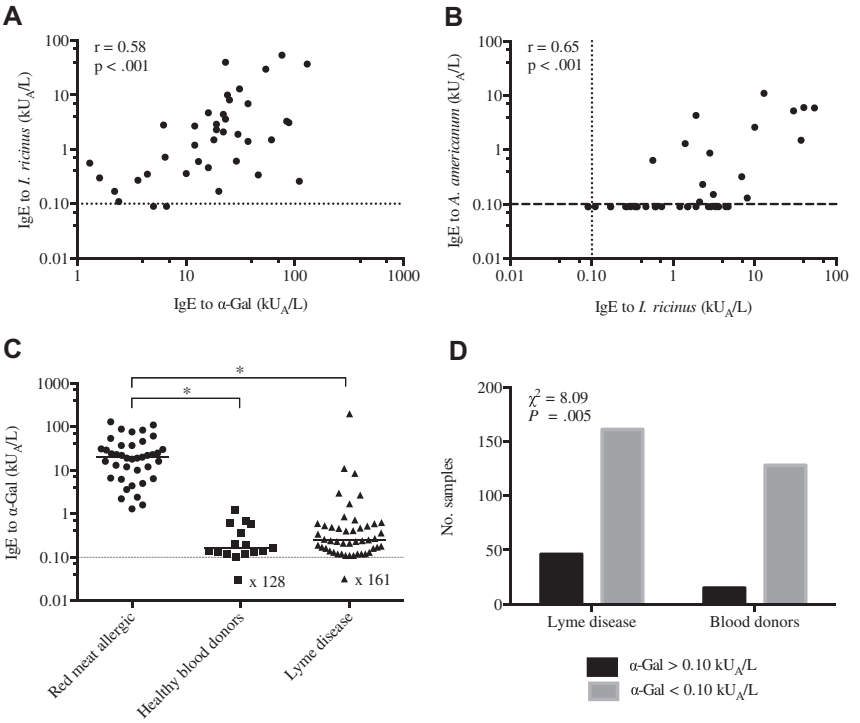

FIG 1. **A** and **B,** Correlations between IgE responses to α-Gal and *I ricinus* (Fig 1, *A*) and *I ricinus* and *A americanum* (Fig 1, *B*) in Swedish patients with red meat allergy. **C,** IgE reactivity to α-Gal in patients with red meat allergy compared with that in healthy blood donors and patients with Lyme disease expressed as kilo-units of allergen per liter. Mann-Whitney *U* tests were performed to assess statistical significance: $*P < .001$. *Solid bars* denote median values. **D,** Prevalence of IgE reactivity to α-Gal in healthy blood donors compared with that in patients with Lyme disease.

α-Gal–containing allergen sources, such as beef and pork, and the majority also had IgE to cow's milk, dog, cat, and moose (see Table E1 in this article's Online Repository at www.jacionline.org). Significant correlations between IgE to α-Gal and the different mammalian allergens were noted (see Fig E1 in this article's Online Repository at www.jacionline.org). Because the medical investigation revealed that all patients had been bitten by ticks, the majority more than 10 times (Table I), we investigated whether our patients were sensitized to the European tick *I ricinus* and whether they also recognized IgE epitopes in *A americanum* (described in the Methods section in this article's Online Repository at www.jacionline.org). We found that all but 2 patients had IgE antibodies to *I ricinus* (Table I). Although the IgE levels to *I ricinus* were less than those to α-Gal, we observed a strong correlation, supporting the association between tick bites and sensitization to α-Gal (Fig 1, *A*). This is in line with the results by Commins et al,[5] who reported an equally strong correlation between IgE to α-Gal and the tick *A americanum* among patients presenting with allergic reactions from the southeastern United States. More than 35% of the patients with red meat allergy reported here were also sensitized to *A americanum*, but the IgE levels were much lower than those to *I ricinus*, suggesting that *I ricinus* is the species to which they were primarily sensitized. However, the IgE antibody levels against both tick species correlated significantly (Fig 1, *B*).

We were also interested in examining the allergenic cross-reactivity between *I ricinus* and *A americanum*. A serum pool of 4 Swedish patients with meat allergy (25 kU_A/L to *I ricinus* and 8.5 kU_A/L to *A americanum*) was preincubated with *I ricinus* or *A americanum* tick extract before measurement of *I ricinus*–specific IgE by mean of ImmunoCAP. The results revealed that the *A americanum* extract was only able to inhibit 37% of IgE binding to *I ricinus* at the highest concentration (81 μg/mL). In contrast, the *I ricinus* extract almost completely inhibited the IgE binding to *I ricinus* (91%) at the same concentration. The results indicate that the 2 tick species share similar allergen epitopes but that they also have species-specific epitopes.

To investigate how common IgE antibodies against α-Gal are in the general population, we screened 143 healthy blood donors from the greater Stockholm area. We found that as many as 10% had IgE antibodies to α-Gal (see Table E2 in this article's Online Repository at www.jacionline.org) compared with 0.7% (1/150) of teenagers from a prospective study on asthma in northern Sweden, where tick bites are rare.[5,8] We also screened 207 patients with Lyme disease as a confirmed recently tick-bitten population and found 22% to have positive IgE levels to α-Gal (see Table E3 in this article's Online Repository at www.jacionline.org). We noted that the IgE titers to α-Gal between healthy blood donors and patients with Lyme disease did not differ and were significantly lower (median titer of α-Gal–positive subjects: 0.16 kU_A/L and 0.25 kU_A/L, respectively) than the levels of the patients with red meat allergy (20 kU_A/L, $P < .001$; Fig 1, *C*). These low levels probably reflect sensitization only and are not predictive of an allergic reaction. However, the frequency of α-Gal–sensitized subjects was significantly higher in the group with Lyme disease compared with the healthy blood donors (46/207 vs 5/143; Fig 1, *D*; $\chi^2 = 8.09$; $P = .005$), which strengthens the role of tick bites for the induction of IgE to α-Gal. When comparing

the patients with red meat allergy with the α-Gal–positive patients with Lyme disease, we found that their median IgE titer to α-Gal was significantly higher and that the correlations between α-Gal and total IgE, as well as *I ricinus*, were significantly stronger. Similarly, IgE responses to *I ricinus* were significantly higher in both frequency (37/39 vs 21/46, $\chi^2 = 23.59$, $P < .001$) and median levels (1.49 vs <0.10 kU_A/L, $P < .001$) in patients with red meat allergy compared with those seen in α-Gal–positive patients with Lyme disease. For both groups, the responses to *I ricinus* correlated with total IgE levels ($r = 0.65$ and $r = 0.52$, respectively; $P < .001$, see Fig E2 in this article's Online Repository at www.jacionline.org).

Because the α-Gal epitope is a major blood group substance of nonprimate mammals and structurally related to blood group B, we investigated the blood type of our population with meat allergy. We found that all but 2 patients belonged to the B-negative blood groups (A or O, 5%) which is significantly less compared with the expected number in the Swedish population (18%; www.geblod.nu). A recent study on the relationship between IgG and IgE responses to α-Gal and blood group B found that none of the B-positive subjects expressed IgE to α-Gal.[9] Also, 86% of the healthy blood donors and 78% of the patients with Lyme disease who had positive IgE levels to α-Gal were B-negative, and in the majority the IgE levels to α-Gal were very low. Taken together, we here report that there is a strong relationship with tick bites for the production of IgE to α-Gal and, for the first time, that red meat allergy is strongly associated with the B-negative blood groups.

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METHODS

Patient and control populations

A total of 39 patients reporting delayed allergic reactions after consumptions of red meat; attending the Allergy Unit at Södersjukhuset, Stockholm, Sweden; and having IgE to α-Gal were enrolled in the study. All patients were examined by a physician experienced in allergic diseases and responded to a detailed questionnaire regarding symptoms of meat intake and exposure to ticks. Blood samples were drawn for analysis of IgE antibodies to a panel of different food and inhalant allergens. The patients were also blood typed according to routine methods (Blood Center, Karolinska University Hospital, Stockholm, Sweden). Sera from 143 healthy blood donors (Blood Center, Karolinska University Hospital) were tested for IgE antibodies to α-Gal. Sera from 207 patients with confirmed *Borrelia* species infection (IgG to *Borrelia burgdorferi*; median ratio, 2.22 arbitrary units (AU); range, 0.9-5.04 AU; cutoff, 0.5 AU [OXOID IDEIA *Borrelia burgdorferi* IgG, OXOID, Cambridgeshire, United Kingdom]; Department of Clinical Microbiology, Karolinska University Hospital) were also tested for IgE antibodies to α-Gal. Subjects in these 2 groups with α-Gal titers of 0.1 kU_A/L or greater were analyzed for total IgE and a panel of allergens. *Borrelia* species–positive sera having an α-Gal level of 0.1 kU_A/L or greater were blood typed. The study was approved by the local ethics committee.

Tick extract preparation

Adult pathogen-free *I ricinus* ticks (IS Insect Service GmbH, Berlin, Germany) were stored at −80°C until preparation of whole-body extracts. Tick extract was prepared by crushing frozen ticks with a tissue homogenizer (Bertin Technologies, Montigny-le-Bretonneux, France) in PBS (pH 7.4). After centrifugation, the supernatant was collected. In addition, extract of adult pathogen-free *A americanum* ticks (Oklahoma State Tick Rearing Facility, Stillwater, Okla) was prepared, as previously described.[E1]

ImmunoCAP IgE determination

Total IgE levels and allergen-specific IgE antibody reactivity to α-Gal, beef, moose, pork, chicken, milk, dog, cat, the major cat allergen rFel d 1 and serum albumin from cat (Fel d 2), and beef (Bos d 6) were determined (ImmunoCAP, Phadia AB/Thermo Fisher Scientific). IgE antibodies against tick proteins (*I ricinus* and *A americanum*) were measured by coupling 5 μg of biotinylated tick antigen to Streptavidin ImmunoCAP, as described by the manufacturer (Phadia AB/Thermo Fisher Scientific). This assay is not commercially available. All IgE determinations were analyzed by using the ImmunoCAP System (Phadia AB/Thermo Fisher Scientific), according to the manufacturer's instructions. The results are presented as kilounits of allergen per liter. The cutoff for total IgE was 2 kU/L or greater, and that for allergen-specific IgE was 0.1 kU_A/L or greater.

Absorption experiments

The capacity of *I ricinus* (2 mg/mL) or *A americanum* (2.6 mg/mL) extracts to inhibit IgE binding to solid phase–bound *I ricinus* (Streptavidin ImmunoCAP) was performed, essentially as described for the ImmunoCAP System (Phadia AB/Thermo Fisher Scientific). However, a prior step of 1-hour preincubation of a serum pool of 4 Swedish patients with meat allergy with 3-fold dilutions (0.01-81 μg/mL) of either extracts from *I ricinus* or *A americanum* was included.

Blood group distribution

The expected ABO blood group distribution was obtained from official national data in Sweden (available at http://www.geblod.nu).

Statistical analysis

Statistical analysis was performed with GraphPad Prism software (version 6; GraphPad Software, La Jolla, Calif). Quantitative measurements of IgE antibodies were compared by using Spearman rank correlation and Mann-Whitney *U* tests. Categorical measures were compared with the χ^2 test for trend. The frequency of B-positive subjects compared with a theoretical outcome was performed by using the binominal test. A *P* value of less than .05 was considered significant.

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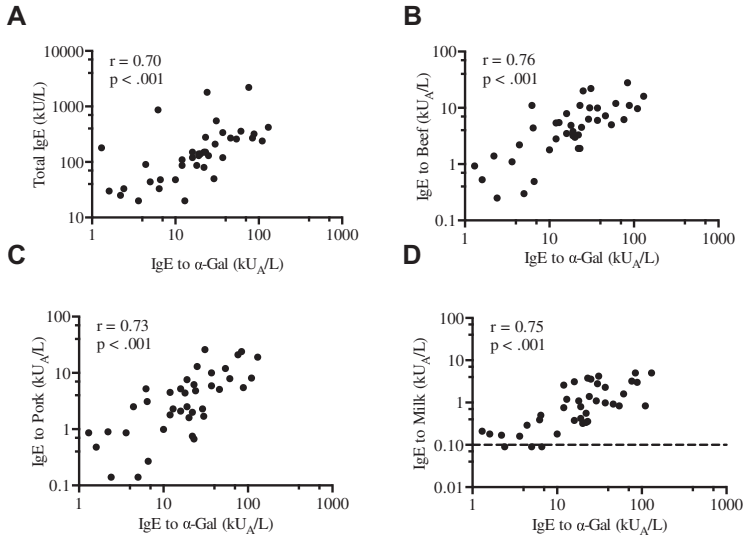

FIG E1. Correlations between IgE responses to α-Gal and total IgE **(A)**, beef **(B)**, pork **(C)**, and cow's milk **(D)** in Swedish patients with red meat allergy.

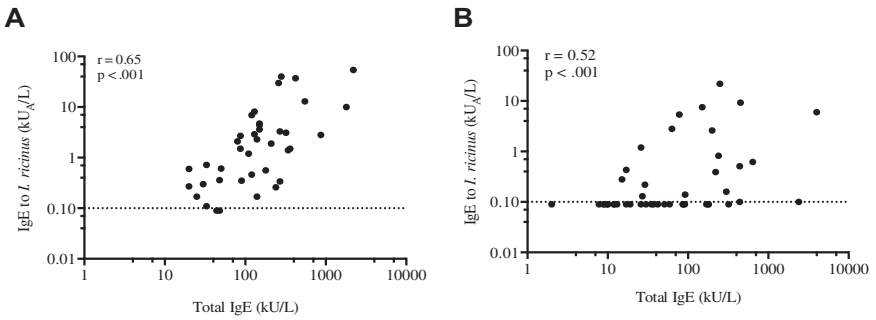

FIG E2. Correlation between IgE responses to *I ricinus* and total IgE levels in patients with meat allergy **(A)** and patients with Lyme disease with positive IgE levels to α-Gal **(B)**.

TABLE E1. Further characteristics of patients with meat allergy

	IgE*						
Patient no.	**Pork**	**Moose**	**Chicken**	**Milk**	**Dog**	**Cat**	**rFel d 1**
1	12	0.84	<0.10	0.84	2.2	1.5	<0.10
2	2.1	0.5	<0.10	0.38	0.83	0.4	0.37
3	2.3	0.3	<0.10	1.2	0.28	0.45	<0.10
4	6.2	2.0	<0.10	3.8	3.4	0.96	<0.10
5	3.1	1.4	<0.10	0.5	1.0	0.24	<0.10
6	1.7	1.0	1.4	2.8	0.61	1.1	<0.10
7	0.9	0.7	<0.10	0.17	0.3	0.64	0.41
8	5.2	2.2	<0.10	3.1	5.3	3.1	<0.10
9	5.5	1.6	0.22	3.0	2.6	1.5	<0.10
10	4.4	1.5	<0.10	1.1	0.98	0.64	<0.10
11	2.5	0.12	<0.10	0.29	0.26	<0.10	<0.10
12	19	3.6	<0.10	5	4.4	1.9	<0.10
13	5.2	0.48	<0.10	0.39	2.4	0.93	<0.10
14	4.8	6.1	0.39	1.4	14	20	12
15	5.1	0.8	<0.10	0.92	1.4	0.41	<0.10
16	26	6.2	0.13	4.2	9.1	3.3	0.15
17	13	2.1	<0.10	3.6	3.1	2.0	0.44
18	1.6	0.28	<0.10	0.32	0.16	0.3	<0.10
19	2.5	1.1	<0.10	0.8	1.1	0.4	<0.10
20	0.86	0.19	<0.10	0.16	0.27	0.11	<0.10
21	0.48	0.21	<0.10	0.18	0.17	<0.10	<0.10
22	2	0.82	0.13	0.56	0.65	0.28	0.16
23	21	0.92	0.4	3.2	6.3	3.5	0.47
24	7.6	0.61	<0.10	0.42	2.7	0.78	<0.10
25	1.8	0.85	<0.10	0.76	2.9	0.53	<0.10
26	2.3	1.0	<0.10	1.1	0.69	0.2	<0.10
27	0.27	<0.10	<0.10	<0.10	0.12	<0.10	<0.10
28	0.99	0.31	<0.10	0.18	0.47	2.4	1.6
29	0.14	<0.10	<0.10	<0.10	0.21	<0.10	<0.10
30	4.5	3.9	<0.10	2.6	1.8	1.3	<0.10
31	5.9	0.89	0.12	0.98	0.61	0.31	<0.10
32	0.14	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
33	10	1.8	<0.10	2.3	1.1	0.72	<0.10
34	8.1	0.69	<0.10	0.84	0.73	0.35	<0.10
35	24	5.4	<0.10	5.0	5.9	2.0	0.23
36	7.9	1.9	<0.10	1.6	1.4	1.9	1.9
37	0.86	0.33	<0.10	0.21	0.21	0.12	<0.10
38	0.75	0.47	<0.10	0.34	0.56	3.0	2.3
39	0.67	0.44	<0.10	0.36	0.53	2.9	2.3

*ImmunoCAP IgE results are presented in kilounits of allergen per liter.

TABLE E2. Characteristics of healthy blood donors with IgE responses of 0.1 kU_A/L or greater to α-Gal

		IgE*									
Sample ID	**Age (y)/sex**	**Total**	**α-Gal**	**Beef**	**Tick**	**Milk**	**Dog**	**Cat**	**rFel d 1**	**Chicken**	**Blood type**
H23	67/M	150	0.16	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	A
H26	38/F	61	0.14	<0.10	<0.10	<0.10	0.10	<0.10	<0.10	<0.10	A
H28	29/M	18	0.12	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	A
H34	36/M	18	0.7	0.3	0.16	0.11	0.10	<0.10	<0.10	<0.10	A
H40	58/M	120	0.14	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	A
H45	22/M	10	0.13	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	A
H48	23/M	860	0.59	<0.10	<0.10	0.32	<0.10	<0.10	<0.10	<0.10	B
H51	47/M	15	1.2	0.27	<0.10	<0.10	0.11	0.26	0.28	<0.10	A
H65	46/F	20	0.2	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	A
H96	65/F	18	0.13	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	O
H114	19/F	9	0.12	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	AB
H118	35/F	110	0.19	0.8	0.13	1.8	6.2	9.8	0.22	<0.10	O
H119	42/M	180	0.1	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	O
H128	55/M	60	0.62	0.14	0.15	<0.10	<0.10	<0.10	<0.10	<0.10	A
H136	62/F	11	0.37	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	A

*ImmunoCAP IgE results (total IgE, kilounits per liter; allergen-specific IgE, kilounits of allergen per liter).

TABLE E3. Characteristics of patients with Lyme disease with IgE responses of 0.1 kU_A/L or greater to α-Gal

	IgE*									
Sample ID	**Total**	**α-Gal**	**Beef**	**Tick**	**Milk**	**Dog**	**Cat**	**rFel d 1**	**Chicken**	**Blood type**
L1	240	8.5	3.2	0.82	0.66	0.34	0.2	<0.10	<0.10	A
L4	35	0.53	0.14	<0.10	0.1	<0.10	<0.10	<0.10	<0.10	A
L6	250	0.85	<0.10	22	0.19	<0.10	<0.10	<0.10	<0.10	A
L14	440	11	1.2	0.51	0.37	0.28	0.11	<0.10	<0.10	AB
L17	12	0.23	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	A
L28	29	0.13	<0.10	0.22	0.22	<0.10	<0.10	<0.10	<0.10	O
L39	17	1.7	0.30	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	O
L44	30	0.12	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	A
L45	320	0.17	0.17	<0.10	<0.10	0.14	<0.10	<0.10	<0.10	A
L68	27	0.24	<0.10	0.13	<0.10	<0.10	<0.10	<0.10	<0.10	O
L71	59	0.12	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	A
L72	7.8	0.12	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	A
L74	13	0.19	0.17	<0.10	0.14	<0.10	<0.10	<0.10	<0.10	O
L75	15	0.12	<0.10	0.28	<0.10	<0.10	<0.10	<0.10	<0.10	O
L81	180	0.26	<0.10	<0.10	0.77	4.7	3.1	2.8	<0.10	O
L95	180	0.11	0.13	<0.10	0.68	0.31	0.68	0.60	<0.10	O
L96	78	0.27	0.11	5.4	<0.10	0.10	<0.10	<0.10	<0.10	O
L99	17	2.7	0.79	0.43	0.26	0.18	<0.10	<0.10	<0.10	O
L100	92	0.36	<0.10	0.14	0.21	NA	NA	<0.10	<0.10	O
L102	450	0.11	<0.10	9.3	<0.10	5.7	8.8	8.5	<0.10	O
L103	9.1	0.18	<0.10	<0.10	0.16	<0.10	<0.10	<0.10	<0.10	B
L106	10	0.46	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	O
L111	63	0.41	0.23	2.8	0.13	0.20	<0.10	<0.10	<0.10	O
L112	150	0.16	<0.10	7.5	0.18	0.25	1.2	1.4	<0.10	O
L116	640	3.0	0.10	0.62	2.4	NA	NA	<0.10	0.13	B
L122	42	0.17	0.16	<0.10	0.77	<0.10	<0.10	<0.10	<0.10	O
L125	220	0.6	0.49	0.39	0.23	1.0	3.1	1.4	<0.10	O
L128	9.9	0.11	<0.10	<0.10	0.15	<0.10	<0.10	<0.10	<0.10	O
L139	12	0.13	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	B
L140	37	0.24	<0.10	<0.10	NA	NA	NA	NA	NA	AB
L144	2	0.21	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	O
L147	91	0.4	0.18	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	A
L149	19	0.25	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	O
L154	4000	200	67	6	17	16	15	7.8	0.14	A
L155	26	0.34	0.17	1.2	<0.10	<0.10	<0.10	<0.10	<0.10	A
L164	87	0.63	0.25	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	A
L166	200	0.72	<0.10	2.6	<0.10	<0.10	<0.10	<0.10	<0.10	AB
L171	51	0.47	0.13	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	B
L175	170	0.14	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	O
L178	26	0.52	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	B
L188	440	0.49	<0.10	0.10	<0.10	<0.10	<0.10	<0.10	<0.10	B
L191	8.8	0.23	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	A
L192	NA	0.21	NA	1.7	NA	NA	NA	NA	NA	B
L195	300	0.59	0.32	0.16	0.12	<0.10	<0.10	<0.10	<0.10	A
L202	2400	0.16	0.76	0.10	0.82	74	>100	>100	<0.10	O
L205	86	0.12	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	O

NA, Not available.

*ImmunoCAP IgE results (total IgE, kilounits per liter; allergen-specific IgE, kilounits of allergen per liter).